REMARKS

Claims 1-5, 8-13 and 18-28, as amended, remain herein. Claims 1 and 2 have been amended to include the limitations of claims 14 and 15. Claims 4, 5, 8, 13 and 18 have been amended for clarity. New claims 19-28 have been added. Claims 14-17 are cancelled. Support for the amendments and the new claims may be found throughout the specification (see, e.g., original claims and page 37, lines 2-6 of applicants' specification).

1. Claims 1-5 and 8-18 were rejected under 35 U.S.C. § 112, first paragraph. The Office Action alleges that the specification does not provide enablement for the full scope of the claims. Independent claims 1 and 2 have been amended to moot this rejection.

MPEP § 2164.08 explains that "the specification must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation'" (citing In re Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993)). However, MPEP § 2164.08 also states that: not everything necessary to practice the invention need be disclosed; what is well-known is best omitted (citing In re Buchner, 929 F.2d 660, 661 (Fed. Cir. 1991)); and all that is necessary is that one skilled in the art be able to practice the claimed invention, given the level of knowledge and skill in the art. MPEP § 2164.08 further states that:

> To provide effective incentives, claims must adequately protect inventors. To demand that the first to disclose shall limit his claims to what he has found will work or to materials which meet the guidelines specified for "preferred" materials in a process such as the one herein involved would not serve the constitutional purpose of promoting progress in the useful arts.

In this case, applicants' invented an organic electroluminescence device comprising a light emitting layer comprising a phosphorescent light emitting material, without employing a

hole blocking layer. Applicants' specification explains that:

> As the result of intensive researches and studies to achieve the above object by the present inventors, the first aspect of the present invention provides an organic EL device, which comprises an light emitting layer consisting of at least phosphorescent light emitting material and a host material, a cathode, and an electron injecting layer adhered to the light emitting layer and at the same time sandwiched between the light emitting layer and the cathode, without employing any hole blocking layer. Further, the first aspect of the invention made the energy gap of electron transporting material in electron injecting layer smaller than that of the host material in the light emitting layer. According to the conventional comprehension by the persons skilled in the art, the above settlement will let the electron injecting layer deactivates the excitation state generated in the light emitting layer and only the EL devices with extremely low efficiency will be provided. In the present invention, however, enabling the light emitting layer electron transporting, an electron-hole recombination zone will separate from the interface between the electron injecting layer and the light emitting layer resulting in avoidance of deactivation. Besides, an EL device with high efficiency without the use of the hole blocking layer in the conventional organic EL device is provided by making the ionization potential of the host material 5.9 eV or lower in order to enable holes easily inject into the host material in the light emitting layer. Further, the driving voltage can be decreased because the holes are injected into the host material in the light emitting layer thereby allowing the transportation, and an organic EL device with long lifetime can be obtained because any hole blocking layer that easily deteriorates is not employed. Furthermore, the organic EL device is easily producible because its constitution became simple. Moreover, it was ensured that the energy gap of electron transporting material in electron injecting layer smaller than that of the host material in the light emitting layer has also an effect of promoting injection of electrons from cathode as well as decreasing the driving voltage.

Applicants' specification at page 5, line 16 to page 6, line 21 (emphasis added here).

A person of ordinary skill in the art can practice the claimed invention without undue experimentation and would know, given the level of knowledge and skill in this art, how to select the various elements of the organic electroluminescence device based on the claimed structural limitations (e.g., a host material having an ionization potential of 5.9 eV or smaller, an electron injecting layer material having an energy gap smaller than that of the host material, an electron injecting layer material having a triplet energy smaller than that of the host material, and/or the host material being an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$

or greater).

Furthermore, to moot this rejection, applicants amended independent claims 1 and 2 to limit the host material to a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole.

Applicants respectfully request reconsideration and withdrawal of this rejection.

2. Claims 1-5 and 8-18 were rejected under 35 U.S.C. § 112, first paragraph. Independent claims 1 and 2 have been amended to moot this rejection.

MPEP § 2173.04 explains that:

> Breadth of a claim is not to be equated with indefiniteness. *In re Miller*, 441 F.2d 689, 169 USPQ 597 (CCPA 1971). If the scope of the subject matter embraced by the claims is clear, and if applicants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. 112, second paragraph.

In addition, the present claims are not indefinite but recite several structural limitations including the various elements of the claimed organic electroluminescence device as well as their physical properties.

Furthermore, to moot this rejection, applicants amended independent claims 1 and 2 to limit the host material to a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, and the ring having

nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole.

Applicants respectfully request reconsideration and withdrawal of this rejection.

3. Claims 1-5 and 8-18 were rejected under 35 U.S.C. § 103(a) over Shirasaki et al. U.S. Patent 5,834,894 in view of Okada et al. US Patent Application Publication 2002/0055014, further in view of Matsushima et al., *Current Applied Physics* **2005**, 5, 305-308; Bernede et al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Spain (2005), 87, 261-270; and Wu et al., Advanced Materials (2008), 20, 2359-2364.

Applicants' claim 1 recites an organic electroluminescence device comprising a cathode, an anode, at least one light emitting layer comprising a phosphorescent light emitting material and a host material, which light emitting layer is sandwiched between the cathode and the anode, and an electron injecting layer which is adhered directly to the light emitting layer, wherein: an ionization potential of the host material is 5.9 eV or smaller; an energy gap of the electron injecting layer material is smaller than that of the host material; the host material is an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$ or greater and is either a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, each ring or group being optionally substituted, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole; and the organic electroluminescence device does not include a hole blocking layer.

Applicants' claim 2 recites an organic electroluminescence device comprising a cathode, an anode, at least one light emitting layer comprising a phosphorescent light emitting material and a host material, which light emitting layer is sandwiched between the cathode and the anode, and an electron injecting layer which is adhered directly to the light emitting layer, wherein: an ionization potential of the host material is 5.9 eV or smaller; a triplet energy of the electron injecting layer material is smaller than that of the host material; the host material is an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$ or greater and is either a compound obtained by bonding carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, each ring or group being optionally substituted, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole; and the organic electroluminescence device does not include a hole blocking layer.

Shirasaki does not disclose applicants' claimed organic electroluminescence device. Shirasaki discloses PVCz as the host material but says nothing about applicants' claimed host material being either a compound obtained by bonding carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, each ring or group being optionally substituted, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole.

Okada discloses various compounds but says nothing about host materials having an

ionization potential of 5.9 eV or less or about the claimed energy gap or triplet energy relationship with the electron injecting layer material. In fact, some of Okada's compounds appear to have an ionization potential greater than 5.9 eV. Compare Okada compound 246 (used in Okada's device 110 (see Okada at Table 1, page 85)) with applicants' Comparative Example 6 (TPBI) which has an ionization potential of 6.7 eV (Table 1 at page 88 of applicants' specification). As demonstrated in applicants' specification, a host material having an ionization potential higher than 5.9 yields inferior luminance and current efficiency even at higher voltage (compare applicants' Example 5 and Comparative Example 6 in Table 1 at page 88 of applicants' specification). Okada also discloses CBP as a host material, but CBP is outside the scope of applicants' claims and is not, unlike applicants' claimed host material, either a compound obtained by bonding carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, each ring or group being optionally substituted, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole.

The Office Action erroneously alleges that the ionization potential of the host material and the claimed energy gap or triplet energy relationship with the electron injecting layer material are inherently present. However, inherency may not be relied upon to establish prima facie obviousness in this case. The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. MPEP § 2112 (citing In re Rijckaert, 9 F.3d 1531, 1534 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what

was necessarily present in the prior art); In re Oelrich, 666 F.2d 578, 581-82 (CCPA 1981) ("To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.")).

Furthermore, Shirasaki uses a fluorescent not a phosphorescent dopant. A person of ordinary skill in this art would know that fluorescent and phosphorescent dopants are not directly substitutable. As explained in applicants' specification, a hole blocking layer was typically used in phosphorescent devices to prevent the quench of triplet excited states and to achieve sufficient device efficiency:

> However, it was found that the conventional constructions for electron injection have problems. Namely, because the hole blocking layer has large energy gap, and because it works with great resistance as an energy barrier for charge injection transport from the other layer, the driving voltage elevated. Further, although many compounds used for the hole blocking layer held favorable hole barrier capability, they tended to deteriorate, and failed to provide an organic EL device with long lifetime.
> ...
> As the result of intensive researches and studies to achieve the above object by the present inventors, the first aspect of the present invention provides an organic EL device, which comprises an light emitting layer consisting of at least phosphorescent light emitting material and a host material, a cathode, and an electron injecting layer adhered to the light emitting layer and at the same time sandwiched between the light emitting layer and the cathode, without employing any hole blocking layer. Further, the first aspect of the invention made the energy gap of electron transporting material in electron injecting layer smaller than that of the host material in the light emitting layer. According to the conventional comprehension by the persons skilled in the art, the above settlement will let the electron injecting layer deactivates the excitation state generated in the light emitting layer and only the EL devices with extremely low efficiency will be provided. In the present invention, however, enabling the light emitting layer electron transporting, an electron-hole recombination zone will separate from the interface between the electron injecting layer and the light emitting layer resulting in avoidance of deactivation. Besides, an EL device with high efficiency without the use of the hole blocking layer in the

> conventional organic EL device is provided by making the ionization potential of the host material 5.9 eV or lower in order to enable holes easily inject into the host material in the light emitting layer. Further, the driving voltage can be decreased because the holes are injected into the host material in the light emitting layer thereby allowing the transportation, and an organic EL device with long lifetime can be obtained because any hole blocking layer that easily deteriorates is not employed. Furthermore, the organic EL device is easily producible because its constitution became simple. Moreover, it was ensured that the energy gap of electron transporting material in electron injecting layer smaller than that of the host material in the light emitting layer has also an effect of promoting injection of electrons from cathode as well as decreasing the driving voltage.

Applicants' specification at page 4, lines 8-14 and page 5, line 16 to page 6, line 21 (emphasis added here). See also Okada Example 1 at paragraph [0236] (showing the use of a hole blocking layer comprising bathocuproine); Baldo et al. US Patent 6,097,147 at column 2, lines 1-26 and column 3, lines 22-60 (discussing the issues with phosphorescent devices and the use of a hole blocking layer); and Thompson et al. US Patent 7,078,113 at column 2, line 55 to column 3, line 6 (discussing the need for a blocking layer to maximize the efficiency of electro-phosphorescent devices). Applicants' claimed invention, on the other hand eliminates the need to use a hole blocking layer.

Neither Shirasaki nor Okada requires that the host material have an ionization potential of 5.9 eV or less, an electron mobility of 10^{-5} $cm^2/V.s$ or greater, and a specific energy gap or triplet energy relationship with the electron injecting layer material. Evidence of long felt but unsolved needs and failure of others (see MPEP § 2145, citing Graham v. John Deere Co., 383 U.S. 1, 17 (1966)), and evidence that the claimed invention yields unexpectedly improved properties or properties not present in the prior art (see MPEP § 2145, citing In re Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990)), rebut alleged obviousness. Applicants' claimed invention solves a long felt problem by eliminating the need for a hole blocking layer and yields unexpected results by achieving great efficiency of light emission without the use of a hole blocking layer (compare

applicants' Example 5 and Comparative Example 6 at Table 1, page 88 of applicants' specification (showing that Comparative Example 6 required higher voltage to achieve about the same efficiency of light emission)).

Thus, applicants' claims are not obvious over Shirasaki in view of Okada. Furthermore, Shirasaki and Okada disclose nothing that would have suggested applicants' claimed invention to one of ordinary skill in the art. There is no disclosure or teaching in any of Shirasaki, Okada, or anything else in this record, that would have suggested the desirability of modifying or combining any portions thereof effectively to anticipate or suggest applicants' presently claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

4. Claim 2 was rejected under 35 U.S.C. § 103(a) over Fujino et al. JP 2000-169448 in view of Okada as evidenced by Tanaka et al., *Japan Journal of Applied Physics* **2003**, 42, 2737-2740.

Fujino does not disclose applicants' claimed organic electroluminescence device. The Office Action admits that Fujino does not teach a phosphorescent dopant in the light emitting layer, and states that Okada teaches phosphorescent dopants. As explained above, a person of ordinary skill in this art would not directly substitute a fluorescent with a phosphorescent dopant.

As explained above, a hole blocking layer is typically used in phosphorescent devices to prevent the quenching of triplet excited states and to achieve sufficient device efficiency (applicants' specification at page 3, line 11 to page 4, line 14). Applicants' organic electroluminescence device eliminates the need for a hole blocking layer and achieves superior efficiency of light emission under lower voltage.

Furthermore, neither Fujino nor Okada requires that the host material have an ionization potential of 5.9 eV or less, an electron mobility of 10^{-5} $cm^2/V.s$ or greater, and a specific energy gap or triplet energy relationship with the electron injecting layer material. As discussed above, these claim limitations are not obvious but achieve great efficiency of light emission without the use of a hole blocking layer.

Thus, applicants' claims are not obvious over Fujino in view of Okada. Furthermore, Fujino and Okada disclose nothing that would have suggested applicants' claimed invention to one of ordinary skill in the art. There is no disclosure or teaching in any of Fujino, Okada, or anything else in this record, that would have suggested the desirability of modifying or combining any portions thereof effectively to anticipate or suggest applicants' presently claimed invention. Applicants respectfully request reconsideration and withdrawal of this rejection.

Accordingly, all claims are now fully in condition for allowance and a notice to that effect is respectfully requested. The PTO is hereby authorized to charge/credit any fee deficiencies or overpayments to Deposit Account No. 19-4293. If further amendments would place this application in even better condition for issue, the Examiner is invited to call applicants' undersigned attorney at the number listed below.

Respectfully submitted,

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